Optimizing social economic factors which affect food security to support Sustainable Development Goals (SDGs)

Muhammad Yamin[1*], *Siti* Ramadani Andelia [2], and *Meitry* Firdha Tafarini[1]

[1]Department of agribusiness, Faculty of Agriculture, Universitas Sriwijaya, Indralaya, South Sumatra, Indonesia
[2]Department of agribusiness, Faculty of Agriculture, Universitas Tridinati, South Sumatra, Indonesia

Abstract. Efforts to reduce hunger continue to face significant challenges. A strategic plan is needed to improve food security. This study aims to describe the implementation of SDGs (Sustainable Development Goals) to improve rice food security and analyze socio-economic factors that affect food security in South Sumatra Province by analyzing secondary data in South Sumatra Province. The analytical method uses multiple linear regression. The data are taken from the Food Security Agency and the South Sumatra Regional Development Planning Agency. The results showed that the condition of food security in South Sumatra for the past 24 years has experienced ups and downs caused by various disasters such as fires and floods that cause crop failure. Socio-economic factors that have a significant effect on food security in South Sumatra include per capita spending on food and the number of poor communities, and factors that do not have a significant effect are rice prices, the average length of schooling, and per capita rice consumption. By focusing on community development to exclude the poor, there needs to be active participation from the community in participating in several existing programs. This study expands on previous research by identifying additional socio-economic factors influencing food security.

1 Introduction

National development must be directed in such a way as to achieve the expected goals and bring about major changes for Indonesia to achieve people's welfare. One of the successes of national development is reducing the level of hunger. One of the serious threats facing humanity today is the scarcity of sufficient food. The increasing population also increases the need for food also increase. Difficulties also arise because food needs are often not properly met. Hunger is a global problem that still occurs a lot. Several factors that cause hunger include the cycle of poverty, food waste, and weakening food security in Indonesia. The problem of food insecurity is generally associated with developing countries, but at the

* Corresponding author: yamin@unsri.ac.id

household level, it also occurs in developed countries, especially in socially vulnerable groups [1].

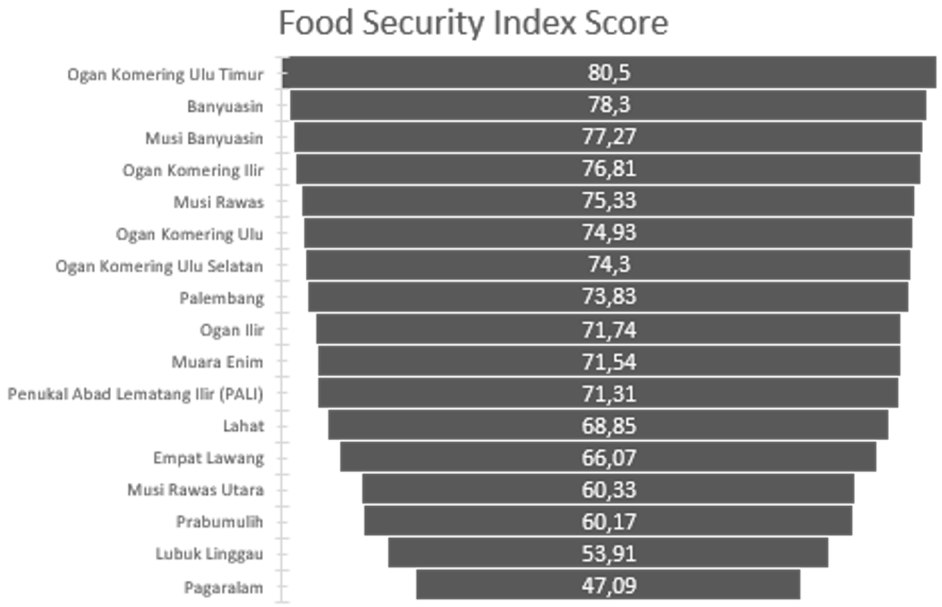
Based on the results of research conducted by the World Food Organization (FAO) in 2023, Indonesia's hunger rate is still ranked 77th in the world. In Indonesia, there are still around 20 million people who go hungry every day. This indicates that they do not have enough food to consume. Research also shows that the main cause of food insecurity is poverty.[2], [3], explained that in Indonesia, it is estimated that every year, hunger will increase with various causes caused by the socio-economic conditions of the community. This socio-economic situation began with the global economic crisis, which had an impact on industrial bankruptcy and increased unemployment, causing further poverty, and will affect the fulfillment of food needs, which can lead to food insecurity.

Eliminating hunger and maintaining good nutrition is one of the goals of the Sustainable Development Goals (SDGs) because its basic goal is to end all forms of poverty everywhere. (Irhamsyah, 2019). Easy access to nutritious food is very important. This is because healthy food is the main source of fulfilling the nutrients needed to carry out daily activities [5]. Through the Sustainable Development Goals (SDGs), it is hoped that the problem of hunger and food security can be resolved in line with the implementation of an economic growth strategy that synergizes with various social issues, ranging from education, health, and equal employment opportunities, while addressing climate change. Food security is defined as all people having physical, social, and economic access to sufficient, safe, and nutritious food to maintain an active and healthy life [6], [7]. Poor nutrition makes the quality of human resources low. The second United Nations Sustainable Development Goals (SDGs) act as a platform for complex food security, providing goals related to agricultural production and nutrient levels [8].

The causes of food access and security are ambiguous, man-made, and slow-starting, which makes it a challenging phenomenon to address. In addition, the complexity of the global food system is increasingly influencing ideas about the power of urban food retail [9], [10]. The literature on how to achieve food security in the region is expanding to include external stakeholder assistance, various social contexts, and issues other than economic and environmental sustainability. However, social problems are no less important [11], [12]. To find out the Condition of Food Security in Indonesia, the National Food Security Agency calculates the 2022 Food Security Index using several indicators used in the preparation of derivatives of 3 aspects of food security, namely, food availability, affordability, and food utilization.

The IKP is used as a reference for determining food insecure areas, including the ratio of normative per capita consumption to net availability; the percentage of the population living below the poverty line; the percentage of households with a proportion of expenditure on food that is more than 65% of total expenditure; percentage of households without access to electricity; the average length of schooling for girls is over 15 years; percentage of households without access to clean water; a ratio of population per health worker to population density; percentage of short toddlers; and life expectancy at birth [13], [14]. In this study, 8 indicators were taken as variables in analyzing socio-economic factors that affect food security, and are supported by research by[15]–[18].

A total of 81 districts out of 416 districts have low IKP scores. 3 cities in the province of South Sumatra are in quadrants 1-3, namely the cities of Lubuk Linggau, Pagaralam, and Prabumulih, which have a score of <60.00 where the districts/cities in quadrants 1-3 are the areas we need to find out why they have not achieved food security. Even though in concept (SDGs), goal 2 is Zero Hunger, meaning that the population of districts/cities in South Sumatra must reach 0%.



Source: National Food Security Agency, Secondary Data Processed, 2022

Fig1. Scores of the South Sumatra Regency/City Food Security Index for 2021

Food insecurity has significant short- and long-term impacts on physical health and social and economic participation [19], [20]. the high reporting of food insecure communities will cause deep-rooted losses, not only marked by low income. It consists of long-term, often intergenerational exclusion from social and economic opportunities, including higher education, employment, and positive social and community-based relationships, which affect all domains of well-being [21], [22]. This study fills the gap in previous research to analyze socioeconomic factors that affect food security, which includes community resilience. To achieve this goal, we traced it through secondary data and then conducted a multiple linear regression analysis on the factors affecting food security in South Sumatra Province.

2 Method

The method used in this research is quantitative and descriptive. A quantitative method is a form of research that is carried out in a systematic, structured, and detailed manner [23]. The descriptive method is a research method that aims to explain an ongoing event in the present or the past (Main, 2016).

The data collected in this research is secondary data. Secondary data was obtained from various sources, namely agencies and institutions related to the research being carried out, such as government agencies in cities, the Central Bureau of Statistics of South Sumatra, the National Food Security Agency, the South Sumatra Food Security Agency, and research-related agencies. This. The data used in this study are from 1990 to 2019. The type of data processed in this study is quantitative data (in the form of numbers). In addition, the authors also get various sources from various literature such as theses, journals, books, and so on.

The variables used are the Number of Food Insecure Communities as the dependent variable and the independent variables as follows: Distribution of Expenditure Per Capita Food Expenditure, Life Expectancy, Poor People, Average School Years of Population, Household

Ability to Access Adequate Drinking Water, Consumption of rice per capita, and the price of rice. Data obtained from various institutions and literature will be collected and then tabulated, and the results will be presented in tabular form. Then the data will be analyzed descriptively by presenting the results obtained in the form of a systematic discussion.

To answer the first objective, which is to describe the condition of food security in South Sumatra by using quantitative data analysis. Descriptive research is conducted to describe a symptom, event, or events that occur factually, systematically, and accurately. This research was conducted to describe events that became the center of research without giving special treatment to these events. Based on [23], descriptive research is research conducted to determine the value of an independent variable, either one variable or more (independent), without making comparisons or connecting other variables. Quantitative data or statistics of food-insecure people for the last 20 years will explain how the conditions are and what the causes are. Answering the second objective is to analyze socio-economic factors that affect food security, distribution of expenditure, the high number of poor people, the high number of households without access to clean water, life expectancy, and the average length of schooling for women > 15 years. Proven by using Multiple Linear Regression analysis using SPSS, the dependent variable is Food Security and the independent variable is the distribution of expenditure, the high number of poor people, the number of households with access to clean water, life expectancy, the average length of schooling for women > 15 years, per capita consumption of rice, and price of rice. The following is an explanation of the variables used. The factors identified in the literature as determinants of food security in South Sumatra Province are as follows.

Table 1. Variable factors that influence food-insecure communities

No	Variable	Units	Explanation
1	Food Insecure Communities	Percentage	Forecasting the achievement of zero hunger by looking at the number of food insecure people until the end of the 2030 Sustainable Development Goals (SDGs).
2	Cost distribution	Percentage	Food expenditure per capita for the province of South Sumatra is calculated using the distribution of food expenditure from total household food expenditure.
3	Life expectancy	Percentage	The estimated mean length of life of newborns.
4	Poor residents	Percentage	individuals or individuals who are below the poverty line (do not have the ability to meet the living needs of clothing, food, and boards).
5	The average length of schooling of the population	Year	The compulsory education rule by the Indonesian government is 12 years. The average length of public schooling in South Sumatra.
6	Household ability to access proper drinking water	Percentage	Households that do not have access to piped water, water pumps, wells, and springs that are protected from rainwater (excluding bottled water).
7	Consumption of rice per capita	kg	Average weekly rice consumption in South Sumatra.
8	Rice Prices	Rupiah	The purchase price of rice per kilogram by the public. The purchase price at the end consumer level.

The multiple linear regression equation can be written as follows:

$$Y = \alpha + \beta 1\ X1 + \beta 2\ X2 + \beta 3\ X3 + \beta 4\ X4 + \beta 5\ X5 + \beta 5\ X5 + \beta 6X6 + \beta 7X7 + e \qquad (1)$$

Where :
Y = Food Insecure Communities
X1 = Distribution of expenditure per capita expenditure on food
X2 = Life expectancy
X3 = Poor people
X4 = Average school years of the population
X5 = Household ability to access proper drinking water
X6 = Consumption of rice per capita
X7 = Price of Rice
β1 – β7 = Coefficient
e = Interference error

To find out whether the multiple linear regression model used in this study meets the classical assumptions or not, a classical assumption test was performed using the multicollinearity test, heteroscedasticity test, and normality test. The normal distribution will form a straight line diagonally, and the plotted data will be compared with the diagonal line. If the data distribution is normal, then the line that describes the actual data will follow the diagonal line. To test this hypothesis, calculations using the SPSS for Windows computational program are used. If the assumption requirements have been met for the regression equation, then testing will be carried out on the regression model and the research hypothesis through the coefficient of determination (R2), the value of the F-test statistic, and the t-test value. To see how big the independent variable is to the dependent variable, you can use the calculation of the coefficient of determination. To test this hypothesis, calculations are used with the SPSS for Windows computational program.

The hypothesis for the regression analysis is:

1. Simultaneous hypothesis using the F value or F significance value. The simultaneous hypothesis decision is seen as of significant value. If the significance of the F-value < α (0.05), hypothesis H0 is accepted. The following is
the hypothesis:

H0: Socio-economic factors simultaneously have a significant effect on food security in South Sumatra

H1: socio-economic factors simultaneously no significant effect on food security in South Sumatra

2. The partial hypothesis uses the t-value or the t-significance mark. If the t value of the significance of each independent variable is < α (0.05), then the H2 hypothesis is accepted. Her is a hypothesis:

H1: There are no socioeconomic factors significant effect on food security in South Sumatra

H2: Socio-economic factors have a significant effect on food security in South Sumatra

3 Results and discussion

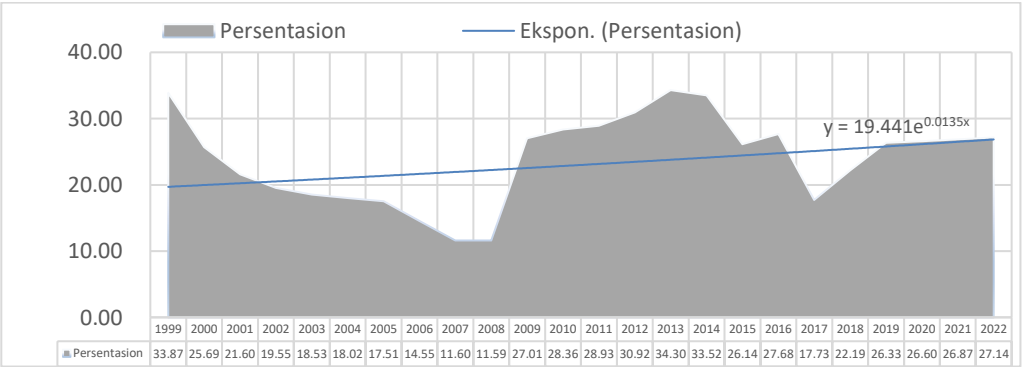
South Sumatra Province's topography varies from coastal areas to lowlands, highlands, and mountains. Many still have forests that distribute most food to rural farming households [25]. The realization of national food security starts with fulfilling food in minor areas, namely villages and sub-districts. Therefore, challenges for problem-reducing problems in every aspect of food security in the community, down to the village and sub-district levels, require continuous monitoring [26], [27]. The attention and evaluation of various parties to evaluate food security at the household level are necessary because food security must be affordable for households and individuals. After that, it will be achieved at the global level.

Agriculture in South Sumatra still needs to improve, such as the low productivity of agricultural products. It is necessary to increase efforts to anticipate the farm sector in handling

hydrometeorological disasters that have the potential to occur until early 2023. Hydrometeorological disasters include floods and tornadoes, as there is an increase in ongoing rainfall due to the active La Nina phenomenon and strengthening Dipole Mode, which causes rainfall to increase above average without experiencing a dry season in most areas of South Sumatra since August 2022, according to the analysis results of the Meteorology, Climatology, and Geophysics Agency (BMKG). Facing an impending disaster, the government has prepared several plans so that people can easily access food.

The Governor is trying to empower 1,000 Agricultural Field Extensionists (PPL) who have been recruited since 2019. The Agricultural Field Extensionists (PPL) who are spread across several agricultural production centers in South Sumatra are expected to be able to educate and motivate farmers to increase the production and quality of agricultural products, as well as overcome various problems faced by farmers. The large role of PPL in helping farmers overcome various problems both at the downstream and upstream levels of agriculture is expected to help the community be free from food insecurity. The government of South Sumatra wants to make South Sumatra a national food storage by creating several work programs, one of which is strengthening agricultural infrastructure to support national food security. The South Sumatra government is increasing the maintenance of agricultural infrastructure covering an area of 220,000 hectares as part of its commitment to support national food security. South Sumatra is expected to be able to contribute to national rice production.

The government of South Sumatra, in realizing the national food storage work program, is not limited to rice plants because the source of carbohydrates is not only rice; there are also sago and tubers, as well as other plants. In addition, it is not only natural factors that are targeted, but also the quality of human resources that need to be considered in carrying out this food storage program. The percentage of the food-insecure population in South Sumatra Province can be seen in Figure 2.



	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Persentasion	33.87	25.69	21.60	19.55	18.53	18.02	17.51	14.55	11.60	11.59	27.01	28.36	28.93	30.92	34.30	33.52	26.14	27.68	17.73	22.19	26.33	26.60	26.87	27.14

Fig 2. Presentation of Food Insecure Communities

Figure 2 explains that the percentage of the food insecure population in South Sumatra since 1999 has fluctuated. In line with the research conducted [28]. Nominally, the number of poor people has not decreased much. In South Sumatra, the level of food insecurity is not too high. South Sumatra is one of the provinces with the "Food Barn" work program, and rice is always a surplus. With the Sustainable Development Goals program, it is hoped that the percentage of the food-insecure population will continue to decline until the end of the Sustainable Development Goals program in 2030.

For having good models, econometric criteria are determined by classical assumption testing. The classical assumption test is a requirement that must be met in a multiple linear regression model so that the model is valid as a prediction tool. This test consists of a normality

test, a multicollinearity test, a heteroscedasticity test, and a heteroscedasticity test. The first stage of the classical assumption test series is to conduct a normality test. The normality test is carried out to determine whether the data used is normally distributed or not. The results of the normality test are obtained from the Statistic Normal P-Plot Test and the Kolmogorov-Smirnov test. The Statistic Normal P-Plot Test can be seen in Figure 3 as follows.

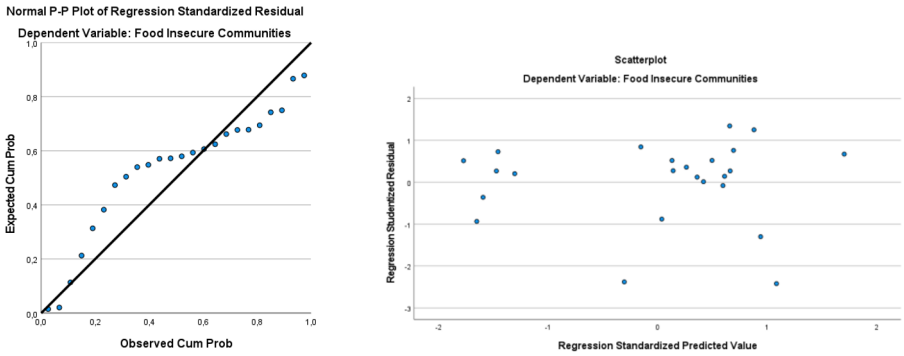


Fig 3. Normality and Heteroskedasity Test

The distribution of the points is close to or close to the diagonal line, meaning that the data has been distributed normally. To be more convincing, the researcher also conducted a Kolmogorov-Smirnov test. Data is said to be normally distributed if the Asymp. Sig (2-tailed) value ≥ 0.05. Based on the table, it means that the data has been distributed normally. So it can be concluded that the data in this study meets the requirements for the normality test and the data has been distributed normally. The second stage of the classical assumption test series is to conduct a heteroscedasticity test. The heteroscedasticity test is processed using the SPSS application with the scatterplot test and the glejser test. It can be seen that the points are spread randomly above and below zero (0) on the Y axis, meaning that the data does not show symptoms of heteroscedasticity.

Table 2. Multicollinearity Test

Coefficients[a]			
Model		**Collinearity Statistics**	
		Tolerance	**VIF**
1	(Constant)		
	Cost distribution	,195	5,123
	Life expectancy	,156	7,941
	Poor society	,234	4,282
	The average length of schooling of the population	,023	43,446
	Household ability to access proper drinking water	,069	14,557
	Consumption of rice per capita	,127	7,844
	Rice Prices	,057	17,454
a. Dependent Variable: Food Insecure Communities			

The third stage of the classical assumption test series is to conduct a multicollinearity test. The multicollinearity test is used to test whether there is a correlation between independent variables in the regression model. The multicollinearity test is seen from the Tolerance and VIF (Variance Inflation Factor) values. With the Tolerance rule ≥ 0.1 and the VIF value ≤ 10, there is no multicollinearity, and vice versa. Based on Table 4.10. The results of all tolerance values

> 0.1 and VIF values <10, meaning that the data in this study did not experience multicollinearity symptoms.

One of the causes of the increase in the percentage of food-insecure population is influenced by the condition of macro food availability, which does not fully guarantee the availability of micro food if the distribution is not evenly distributed, according to research [29]. Production that occurs in certain areas remains difficult to access for people in other areas whose purchasing power is low because the income of the majority of the population who work as farmers is low, in line with the results of the study by [30].

This condition causes food insecurity. According to the Agricultural Research and Development Agency, the causes of food scarcity and food insecurity that occur are influenced by the absence of food production for distribution, and disruption of food distribution in detail as follows:

Knowing what socio-economic factors influence food security in South Sumatra, a multiple linear regression analysis was carried out. The dependent variable used is the food insecure population (Y), while the independent variables used are expenditure per capita for food (the proportion of food expenditure) (X1), life expectancy (X2), number of poor people (X3), average length schools (X4), the number of households with access to proper drinking water (X5), consumption of rice per capita per week (X6), and the price of rice (X7). Classical assumption test requirements must be met to make good modeling because before estimating a multiple regression model, the data used must be free from classical assumptions. The data used in this study have passed the classical assumption test.

3.1 Determination coefficient test

The coefficient of determination test is used to see the feasibility of research conducted by looking at the effect of the independent variables on the dependent variable. The coefficient of determination R2 is used to see what percentage of the influence of the dependent variable can be explained by the independent variable. The results of statistical data processing in this study indicate that the independent variables can explain 53% of the dependent variable, while the remaining 47% is explained by other variables not included in this model. The following is Table 3. The results of the test for the coefficient of determination.

Table 3. Results of the Coefficient of Determination

Summary models

Model	R	R square	Customized R square	std. error in Estimation	Durbin-Watson
1	, 664a	,530	,324	5.47604	1,247

Source: Processed secondary data

The results of the coefficient of determination test above mean that there are still other independent variables that affect food security in South Sumatra. To better understand these issues, future research should look at these additional factors and focus on specific areas, such as districts or villages. This will help leaders create better plans that address the unique needs of different communities. In addition, who owns the land and how well it is managed is important because if people are uncertain about their land rights or if land is divided into small blocks, it can make farming less productive, which can lead to food shortages. Teaching farmers better ways to grow food and reduce waste is also important. Health and nutrition are also key; if people don't have enough good food or health services, their ability to work and grow food can suffer. Government programs that help people, especially those in need, are essential to ensuring everyone has enough to eat. Local traditions and the types of foods people prefer can

also influence what and how much food is produced and eaten. Finally, major changes in the economy, such as rising food prices or problems getting food, can make it harder for families with less money to get enough to eat.

3.2 F test results

The results of the F test or simultaneous test aim to test the hypothesis that explains the socio-economic factors that affect food security in South Sumatra. Simultaneous test results can be seen in Table 3.

Table 4. Simultaneous Test Results

ANOVA						
Model		**Sum of Squares**	**df**	**Average Squared**	**F**	**Sig.**
1	Regression	448,931	4	112,233	3,743	,021b
	remainder	569,752	19	29,987		
	Total	1018683	23			
A. Dependent Variable: Food Insecure Society						
B. Predictors: (Constant), Consumption of rice per capita, Life Expectancy, Poor People, Distribution of Per Capita Expenditures on Food						

The significance value is below 0.05, which indicates that the independent variable simultaneously has a significant effect on the dependent variable at a significance level of 5%. Based on the data above, the calculated F value is 3.743 with a significance value of 0.021, which is below 0.05 and indicates that the independent variables simultaneously have a significant effect on the dependent variable at a significant level of 5%.

A variable is independent in a way to jointly affect the dependent variable. This means that the hypothesis is that socio-economic factors that affect food security in South Sumatra are the distribution of expenditure, number of households with proper drinking water, number of poor people, life expectancy, average female school population aged > 15 years, rice consumption per capita, price Rice or the initial hypothesis is accepted.

3.3 T-Test Results

The t-test or partial test aims to test hypotheses individually. The partial test on the results of statistical calculations is shown by the t-count and explained in Table 4. The results of the t-test or partial test. To test the effect of each independent variable on the dependent variable individually. It was found that the four variables did not all affect the dependent variable. Only two independent variables have a significant influence, namely the variable distribution of expenditure per capita expenditure for food and the number of poor people.

Table 4. T-test results

Model	Nonstandard Coefficient		Standard Coefficient	Q	Sig.
	B	std. Error	Betas		
(Constant)	-72,207	95,352		-,757	,458
Distribution of Per Capita Food Expenditure	1,271	,467	,847	2,719	,014
Life expectancy	1,079	1.122	,277	,961	,348
Poor society	.036	,012	,826	2,902	,009
Consumption of rice per capita	-2,928	6,631	-,106	-,442	,664

Source: Processed secondary data

While the probability of significance of less than 10% means that the independent variables have a significant effect on the dependent variables. Based on the regression coefficients, it can be seen that the per capita expenditure variable for food and the percentage of poor people have a significant effect on food security in South Sumatra. Meanwhile, the variables of life expectancy and rice consumption per capita have no significant effect on food security in South Sumatra.

The multiple linear regression equation for the number of food-insecure populations can be formulated as follows:

$$Y=-72.07+1.271(X1)-0.079(X2)+0.036(X3)-2.928(X6) + e \quad (1)$$

With Variables (X1) Distribution of Expenditure Per Capita Expenditures for Food, (X2) Life Expectancy, Percentage (X3) of the Poor, Percentage (X6) Consumption of rice per capita. The constant value (a) has a negative value of -72.07. The positive sign indicates a unidirectional effect between the independent and dependent variables. All independent variables, which include (X1), (X2), (X3), and (X6), have a value of 0 percent or do not change, so the value of the food insecure population will decrease by 72.02%.

According to BPS, the prevalence of food insufficiency is a condition in which a person regularly consumes an insufficient amount of food to provide the energy needed to live a normal, active, and healthy life. With the adequacy of socio-economic factors that influence food insecurity, the number of people who are food insecure will also decrease. The higher the prevalence of food insufficiency, the higher the percentage of the population consuming food but less than their energy needs. This indicator can also describe changes in food availability and household ability to access food.

3.4 The effect of per capita food expenditures on food security

Regression coefficient values for variables distribution of Per Capita Food Expenditure (X1), which is equal to 1.271. This value indicates a positive (unidirectional) effect between the variables of the poor and the food-insecure communities and production distribution. This means that if the variable distribution of spending on food has increased by 1%, then the variable Food Insecure Communities will increase by 1.271. Assuming that other variables remain constant.

Based on this, more spending per capita on food for the people of South Sumatra will increase the number of food-insecure people in South Sumatra. In line with research [31], which shows that grain prices, other consumer prices, and household income have a positive effect on household food security. At the household level, access to food is achieved when a person receives food in sufficient quantity with adequate quality and quality to ensure a nutritious and

safe diet. To achieve access to food, both domestic and local food must be accessible, and most importantly, households must also have access to important means of obtaining food.

In line with research by [32], [33] which states that the higher the expenditure for food to buy rice, the lower the welfare of the household concerned. Conversely, the smaller the portion of spending on rice, the more prosperous the household is because the ratio of purchasing rice is smaller compared to tertiary and other secondary needs. This is in line with the research we conducted, which stated that spending on consumption is high, so the percentage of the population that is food insecure will also be higher. This is because households with the highest share of food expenditure are classified as households with a low level of welfare compared to households with a low proportion of food expenditure.

The theory of the consumption function agrees with our research. According to Keynes, an increase in income also affects the ratio of consumption to total income, where when income is higher, the ratio of total consumption to income decreases. This is denoted in the average propensity to consume (APC) equation or the average tendency of consumption. When income is higher, the value of the comparison between absolute consumption and income decreases, so the APC value decreases. We suggest efforts to increase community income through empowerment programs that can be carried out, namely: 1) facilitating community access and providing teachings on business capital loans through the national rural community empowerment program. 2) promotion in the development of work motivation and entrepreneurship by utilizing the available environment. 3) skills training to develop rural economic enterprises.

3.5 Effect of life expectancy on food security

The current acceleration of population growth poses a major challenge to efforts to feed the world. In 2050, the threat of a food crisis looms over the world. The Food and Agriculture Organization (FAO) predicts that by 2050, there will be a worldwide food shortage as the world population is expected to exceed 9 billion. Similar to the national situation, the population growth rate of over 200 million people poses challenges in meeting food needs.

There is a one-way influence between community variables, food-insecure communities, and life expectancy. If variable life expectancy has increased by 1%, then the variable food insecure communities decreased by 1.079. The higher the expected number of a region or country shows the better the degree of health. Life expectancy is used to describe the condition of people's welfare in an area in the health sector, by describing the probability of the average age that a person can reach. Life expectancy in counties is lower than in cities. Life expectancy in an area can be influenced by several factors, namely demographic changes, differences in socio-economic conditions, and the availability of health facilities. High life expectancy indicates that the country is a developed country. In line with research by [34], the high vulnerability of food security in West Java Province is the low life expectancy in regencies/cities in West Java Province.

It is hoped that related agencies can increase the promotion of community behavior regarding health, nutrition, sanitation, hygiene, and care, as well as community empowerment, especially among housewives, to accelerate the diversification of local food-based food consumption (creating interest or preference in the community). consumption of fish food, livestock products, local vegetables, and fruits), and nutritional enrichment of certain foods through the technological improvement of the composition of the nutritional content of certain processed foods that are traded. How to extend the life expectancy of a region not only depends on the authority of the local government but is also supported by the behavior of the community to always adopt a healthy lifestyle by utilizing knowledge-based natural resources. For growing vegetables, fruit,

3.6 Effect of the number of poor population on food security

Poverty causes food insecurity, as well as conditions of food security that are vulnerable to being a source of poverty. Even though there is a downward trend in the number of poor people in Indonesia, this is not a reason for the government to no longer consider poverty as a problem in its development priorities. As long as poverty is still high in Indonesia, it can be said that development carried out by the government has not had an impact on improving people's welfare. Food insecurity is strongly influenced by people's purchasing power, which is determined by their income level.

The results of our research show that if the number of variable poor societies experienced a 1% increase, the food-insecure communities will decrease by 0.036. Household size and income are also determinants of food security [16]. Residents can be said to be poor if their income is below the poverty line determined by the provincial government. Calculation of the percentage of poor households is intended to find out how many households cannot access food economically. In line with the research conducted [35] regarding food security in South Sumatra that if the poor population increases, the number of people who are food insecure will also decrease. Efforts to increase food security in South Sumatra Province are important. Furthermore, in line with research by [36], [37]who found that from 2011 to 2020, the number of poor people in Jambi Province had a positive and significant effect on income inequality.

An increase in the number of poor people can exacerbate the income gap in Ghana. When there is a disproportionate number of poor people in a country relative to its population, economic development initiatives have not been successful. In developing countries, inequality will worsen due to the emergence of high-income groups.

Poverty reduction is one of the objectives in the goal of sustainable development. If the poverty rate is successfully reduced, income inequality will also decrease.

3.7 Effect of rice consumption per capita on food security

The affordability of food is closely related to the causes of food insecurity. Communities, namely individuals/households without economic access, are expected to be able to obtain food with easy food affordability. This results in the fulfillment of sufficient food in quantity, quality, variety, and safety. This economic access is more inclined to the issue of staple food prices. The high price makes it difficult for people to obtain food. Strengthening food diversification and local agricultural initiatives will improve food security among low-income populations

Regression coefficient values for variable consumption of rice per capita (X6), which is -2.928. This value indicates a negative influence (opposite direction) between variables. This means that if the variable rice consumption per capita has increased by 1%, then the opposite variable, food insecure communities, will decrease by -2.928. Assuming that other variables remain constant.

Access to food is a link between aspects of food availability and food consumption. Cities/regencies can use the results of this grouping to achieve, maintain, and improve food security status through inter-regional cooperation in meeting the food needs of the community. Especially in terms of fulfilling the availability of rice. The condition of people who can access rice easily can be categorized as people who can access food. Then the number of people who are vulnerable to access to food will decrease.

The Ministry of Agriculture is increasingly aggressively realizing the acceleration of food diversification to reduce dependence on food consumption, which tends to focus on one carbohydrate source commodity. With efforts to increase the production of corn, cassava, sago, potatoes, bananas, and taro with additional assistance from PPL, the achievement of food diversification, namely reducing rice consumption and increasing consumption of local

food sources of non-rice carbohydrates, can be achieved. achieved. To strengthen food diversification, a strategy is needed through reforming food institutions, including farmer group institutions and other financial institutions such as cooperatives. This is done because farmer groups can play a role in the production, distribution, processing, and consumer sectors.

4 Conclusion

Socio-economic factors that have a significant effect on food security in South Sumatra include the variable expenditure per capita for food and the percentage of poor people that have a significant effect on food security in South Sumatra. Meanwhile, the variables of life expectancy and rice consumption per capita have no significant effect on food security in South Sumatra. It is hoped that people with low incomes will be able to increase food production, strengthen food reserves, and provide locally-based food. To strengthen food diversification, a strategy is needed through reforming food institutions, including farmer group institutions and other financial institutions. \Strengthening food reserves: Building up community food reserves, particularly in rural areas, could help mitigate the impact of food price volatility and provide security during lean seasons an Locally-based food provision: A focus on promoting local food systems, such as encouraging urban and rural farming, and strengthening the local food supply chain, can improve access to diverse and nutritious food, especially for low-income households. This research enriches previous research on the socio-economic conditions of food security in various provinces in Indonesia. Some of the limitations of this study are the limited data for each district in South Sumatra, and direct data covering all provinces, so it cannot represent which districts must receive special attention from policymakers in a comprehensive manner to improve the current food security area to improve the food security of society.

References

1. A. Poczta-Wajda, A. Sapa, S. Stępień, and M. Borychowski, “Food insecurity among small-scale farmers in Poland,” *Agric.*, **10**, 7, pp. 1–24, 2020, doi: 10.3390/agriculture10070295.
2. I. Tanziha and E. Herdiana, “Analisis Jalur Faktor-Faktor Yang Mempengaruhi Ketahanan Pangan Rumah Tangga Di Kabupaten Lebak, Propinsi Banten,” Institut Pertanian Bogor, Bogor, 2009. doi: 10.25182/jgp.2009.4.2.109-115.
3. D. S. Sumardilah and A. Rahmadi, “Faktor-faktor yang Berhubungan dengan Ketahanan Pangan Rumah Tangga (Factors related to household food security),” *J. Keperawatan*, **XI**, no. 2, pp. 270–278, 2015.
4. Fahmi Irhamsyah, “Sustainable Development Goals (SDGs) dan Dampaknya Bagi Ketahanan Nasional Dampaknya Bagi Ketahanan Nasional,” *J. Kaji. LEMHANNAS RI*, **38**, pp. 45–54, 2019, [Online]. Available: https:/ib.ui.ac.id/detail?id=20498255&lokasi=lokal
5. K. Joshi-Reddy et al., “Adolescent diet and physical activity in the context of economic, social and nutrition transition in rural Maharashtra, India: A qualitative study,” *Public Health Nutr.*, **24**, 16, pp. 5299–5308, 2020, doi: 10.1017/S1368980020002220.
6. E. Summary, “The State of Food Insecurity in the World 2012 世界の食料不安の現状 主なメッセージ,” in *Addressing Food Insecurity in Protracted Crises*, Rome, Italy, 2015, pp. 1–6.

7. FAO, "Transforming Food and Agriculture To Achieve," *Food Agric. Organ. United Nations.*, pp. 1–71, 2018.
8. L. J. Veldhuizen et al., "The Missing Middle: Connected action on agriculture and nutrition across global, national and local levels to achieve Sustainable Development Goal 2," *Glob. Food Sec.*, **24**, 2020, doi: 10.1016/j.gfs.2019.100336.
9. V. Tuomala, "Towards Inclusive Urban Food Supply Chains," *Food Supply Chain. Cities Mod. Tools Circ. Sustain.*, pp. 1–32, 2020, doi: 10.1007/978-3-030-34065-0_1.
10. L. Klerkx and D. Rose, "Dealing with the game-changing technologies of Agriculture 4.0: How do we manage diversity and responsibility in food system transition pathways?," *Glob. Food Sec.*, **24**, 2020, doi: 10.1016/j.gfs.2019.100347.
11. A. Touboulic and H. Walker, "Theories in sustainable supply chain management: A structured literature review," *Int. J. Phys. Distrib. Logist. Manag.*, **45**, 1, pp. 16–42, 2015, doi: 10.1108/IJPDLM-05-2013-0106.
12. C. G. Davis, M. Moussie, J. S. Dinning, and G. J. Christakis, "Socio-economic determinants of food expenditure patterns among racially different low-income households: An empirical analysis," *West. J. Agric. Econ.*, **8**, 2, pp. 183–196, 1983, doi: https://doi.org/10.2307/40987619.
13. Y. N. Aini and F. E. Kurniawan, "Analisis Faktor dan Pemetaan Ketahanan Pangan Provinsi Papua dalam Upaya Mendukung Sustainable Development Goal's di Indonesia (Analysis and Mapping Factors for Food Security in Papua Province in Efforts to Support Sustainable Development Goals in Indones," *Menaksir Gerak dan Arah Pembang. Indones. Timur*, no. 2019, pp. 89–99, 2019, [Online]. Available: https://www.researchgate.net/publication/344287928
14. J. Lambden, O. Receveur, and H. V. Kuhnlein, "Traditional food attributes must be included in studies of food security in the Canadian Arctic.," *Int. J. Circumpolar Health*, **66**, no. 4, pp. 308–319, 2007, doi: 10.3402/ijch.v66i4.18272.
15. J. Blekking, K. Waldman, C. Tuholske, and T. Evans, "Formal/informal employment and urban food security in Sub-Saharan Africa," *Applied Geography*, 2020.
16. A. Mazenda, P. Manzi, T. Mushayanyama, and S. Ngarava, "Household level determinants of food security in the City of Tshwane, South Africa," *Food Res.*, **6**, 6, pp. 184–192, 2022, doi: 10.26656/fr.2017.6(6).915.
17. S. Anand, K. Jagadeesh, C. Adelina, and J. Koduganti, "Urban food insecurity and its determinants: a baseline study of Bengaluru," *Environ. Urban.*, **31**, 2, pp. 421–442, 2019, doi: 10.1177/0956247819861899.
18. S. Song, J. C. L. Goh, and H. T. W. Tan, "Is food security an illusion for cities? A system dynamics approach to assess disturbance in the urban food supply chain during pandemics," *Agric. Syst.*, **189**, p. 130145, 2021, doi: 10.1016/j.agsy.2020.103045.
19. S. Booth and A. Smith, "Food security and poverty in Australia -- challenges for dietitians.," *Aust. J. Nutr. Diet.*, **58**, 3, pp. 150–156 7p, 2001, [Online]. Available: http://search.ebscohost.com/login.aspx?direct=true&db=cin20&AN=106966090&site=ehost-live
20. A. N. Seivwright, Z. Callis, and P. Flatau, "Food insecurity and socioeconomic disadvantage in Australia," *Int. J. Environ. Res. Public Health*, **17**, 2, p. 559, 2020, doi: 10.3390/ijerph17020559.
21. R. McLachlan, G. Gilfillan, and J. Gordon, "Deep and Persistent Disadvantage in Australia," 2013.
22. S. Kleve, D. Gallegos, S. Ashby, C. Palermo, and R. McKechnie, "Preliminary validation and piloting of a comprehensive measure of household food security in Australia," *Public Health Nutr.*, **21**, 3, pp. 526–534, 2018, doi: 10.1017/S1368980017003007.

23. Sugiyono, *Metode Penelitian Kuantitatif, Kualitatif, dan R&D (Quantitative Research Methods, Qualitative, and R&D)*. Bandung: Alfabeta, 2015.
24. G. Pratama, "Pelaksanaan Program Pengembangan Kabupaten Serang (Implementation of the Aropolitan Area Development Program, Baros District, Serang Regency)," Universitas Sultan Agung Tritayasa, 2016.
25. J. Adhikari, H. Ojha, and B. Bhattarai, "Edible Forest? Rethinking Nepal's Forest Governance in the Era of Food Insecurity," *Int. For. Rev.*, **18**, 3, pp. 265–279, 2016, doi: 10.1505/146554816819501646.
26. N. Putri and M. Hasan, "Keterkaitan Pasar Kalangan Desa dengan Aksesibilitas dan Ketersediaan Pangan Rumah tangga Petani (Studi Kasus pada Petani Sawah di Sumatera Selatan)," *J. Ekon. Pertan. dan Agribisnis*, **5**, 1, pp. 27–36, 2021, doi: 10.21776/ub.jepa.2021.005.01.03.
27. M. D. Smith, M. P. Rabbitt, and A. Coleman- Jensen, "Who are the World's Food Insecure? New Evidence from the Food and Agriculture Organization's Food Insecurity Experience Scale," *World Dev.*, **93**, pp. 402–412, 2017, doi: 10.1016/j.worlddev.2017.01.006.
28. J. Arifin, "Budaya Kemiskinan Dalam Penanggulangan Kemiskinan Di Indonesia (Poverty Culture in Poverty Reduction in Indonesia)," *Sosio Inf.*, **6**, no. 2, pp. 114–132, 2020, doi: 10.33007/inf.v6i2.2372.
29. V. Tuomala and D. B. Grant, "Exploring supply chain issues affecting food access and security among urban poor in South Africa," *Int. J. Logist. Manag.*, **33**, 5, pp. 27–48, 2021, doi: 10.1108/IJLM-01-2021-0007.
30. J. Hammond et al., "Poverty dynamics and the determining factors among East African smallholder farmers," *Agric. Syst.*, **206**, no. June 2022, p. 103611, 2023, doi: 10.1016/j.agsy.2023.103611.
31. A. N. Ulfa and M. Masyhuri, "Analisis Ketahanan Pangan Rumah Tangga Di Kabupaten Lampung Tengah," *J. Ekon. Pertan. dan Agribisnis*, **3**, 2, pp. 233–243, 2019, doi: 10.21776/ub.jepa.2019.003.02.2.
32. L. Yustika Devi, Y. Andari, L. Wihastuti, and K. Haribowo, "Model Sosial-Ekonomi Dan Ketahanan Pangan Rumah Tangga Di Indonesia (Socio-Economic Model and Household Food Security in Indonesia)," *J. Ekon. dan Pembang.*, **28**, 2, pp. 103–115, 2020, doi: 10.14203/jep.28.2.2020.103-115.
33. T. J. Sekhampu and F. Niyimbanira, "Analysis Of The Factors Influencing Household Expenditure In A South African Township," *Int. Bus. Econ. Res. J.*, **12**, 3, p. 279, 2013, doi: 10.19030/iber.v12i3.7671.
34. A. R. T. Hidayat, M. Dito, and G. Prayitno, "Hubungan Spasial dalam Ketahanan Pangan tingkat Kabupaten / Kota di Provinsi Jawa Barat Spatial Correlation and Food Security in West Java Province," *Pembang. Wil. dan Perenc. Partisipatif*, **14**, 2, pp. 188–204, 2019.
35. R. D. Yulianti and V. Ratnasari, "Pemodelan Faktor-Faktor yang Memengaruhi Ketahanan Pangan di Indonesia Menurut Kabupaten dan Kota Menggunakan Regresi Probit Ordinal," *J. Sains dan Seni ITS*, **9**, no. 2, pp. 2337–3520, 2021, doi: 10.12962/j23373520.v9i2.55484.
36. D. Wahyuningrum and S. Aisyah, "Do Government Policies and Socioeconomic Conditions Affect Income Inequality?," *Econ. Dev. Anal. J.*, **12**, no. 1, pp. 13–25, 2023, doi: 10.15294/edaj.v12i1.63464.
37. Y. Sari, A. Soleh, and W. Wafiaziza, "Analisis Pengaruh Pendidikan Dan Penduduk Miskin Terhadap Ketimpangan Pendapatan Di Provinsi Jambi (Analysis of the Influence of Education and Poor Population on Income Inequality in Jambi Province)," *J. Dev.*, **9**, no. 2, pp. 169–180, 2021, doi: 10.53978/jd.v9i2.182.